to increasingly bear on the engineering enterprise. Take, for example, manufacture and assembly, one of the less glamorous areas. In 1798, the US Government gave a great boost to the cause of standardization and manufacture employing interchangeable parts, by giving a contract to Eli Whitney for the manufacture of 10,000 muskets. But after World War II, especially towards the seventies, the US found itself struggling to compete with the resurgent nations of Europe and Japan with their modern plants and high motivation. This was mainly because of overconfidence and complacency with regard to manufacturing and assembly. The book is very strong in clearly bringing out the complex and interdisciplinary nature of the field.

There are many examples, stories and anecdotes, some from the author's own career and practice, used to illustrate the multifacetedness of engineering practice. The title stories deal with the evolution of the graceful supports used in medieval cathedrals, the development of the steam engine and the well known problem that caused the catastrophic failure of the Space Shuttle *Challenger*. Here let me just mention a few that I found very interesting. Take the development of CT scanners, a case of classic applied science. Although the Radon transform had already been developed, the physicist Allan Cormack essentially rediscovered it and, more importantly, showed, around 1957, how it could be used with a practical machine to get images orders of magnitude better than those that could be obtained with conventional X-rays. Although he published his work there was little interest in it, even among the medical profession. This work was rediscovered and further developed around 1967 by G. Hounsfield, who had the advantage of the backing of a large corporation, EMI Limited. Primarily because the social and economic environment were now conducive, EMI was able to translate the invention into a marketable product and actually make money on the device. And as usually happens in such circumstances where large sums of money are to be made, competition arose very soon, and EMI ultimately lost the business to General Electric, mainly because GE had a huge marketing force and much bigger resources. An instructive story; as an aside, Cormack and Hounsfield won the 1979 Nobel Prize for Medicine.

Or take the problem of how to teach design to *non-engineering and non-science* students, something I would have thought not possible. Normally, the design course even for engineers is one of the most problematic ones since design involves very much more than analysis and is in that sense 'soft'. Amazingly, Adams is able to sufficiently instruct and motivate his students that as their project he is able to set them the task of designing and *actually building* a small electrical vehicle. And the students are successful, since there is a photograph of their working vehicle! Or take the case of Adams' uncle, a machinist by profession with little technical education, who rose to be a foreman and then a general manager. Being an extremely good machinist with a taste for fine machinery, on retirement he spent his time designing and building sophisticated specialty equipment in his garage. An automatic high speed machine to make small lemon pies and a working steam engine with a piston approximately the size of a grain of rice are examples of his *ouvre*. These are the stories that remind us how great a country the US is, not its ability and taste for bullying other countries. If we are to be more productive as a nation, we need to create environments in our schools, universities and work places where the talents of individuals, irrespective of their nominal qualifications, will be recognized and allowed to blossom.

The book is not without weaknesses. I did not enjoy Adams' discussion of the history of technology. The book is written for an American audience and so it is, naturally, Eurocentric; there is little mention of technology prior to AD 1600 and Asian contributions are hardly mentioned. And the author's style certainly doesn't compare with that of, say, D. D. Kosambi. But these are small matters. The writing is clear and simple and so the book is eminently readable. A great merit is that it can be enjoyably read by anyone with little or no technical background. No doubt the book should be in the libraries of all colleges of science and engineering and should be read by those who administer such colleges and those who teach engineering and engineering design. But I'd go further; engineering is a part of our twentieth century culture and so it should be read by all cultured people.

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Science Matters: The Principles of Science Simply Explained. Robert M. Hazen and James Trefil. Universities Press, 3-5-820, Hyderguda, Hyderabad 500 029, India. 1996. xix + 294. pp. Price. Rs 135.

Imagine trying to convince a young person, brought up on a diet of MTV and ESPN that science matters. The most successful people of the turn of this century (among them, notably, Madonna, the many Michaels – Jackson (MTV), Jordan (ESPN) and Johnson (ESPN)) did not need science in a personally enabling way to get there. Yet it is science, and technology, that delivers them to the living room, in a global village, amplifying and distorting them in proportions grotesque to their relative abilities to improve the physical quality of life. The Whittles and von Ohains are so easily forgotten.

This book is a sincere attempt to convey the principles of science to the MTV generations – from teenagers to baby-boomers alike – in a simple and sometimes simplistic way, always avoiding subtlety. Madonna fans should have no difficulty in following the thread of presentation here.

From absolute zero (p. 28) to the Z particle (p. 126, 128), lucid and compressed, almost telegraphic, explanations are offered, with the underlying scientific principles shown to be simple, but of crucial importance, both for unifying the understanding of the universe and for the making of the modern world, through technology.

The book is divided into 18 chapters, with the introductory chapter outlining the epistemological confidence that the universe might be complex, but is regular and based on simple principles which are knowable thereby making it predictable. This deterministic view is upheld throughout, with only minor concessions to the notion of chaos, but little made regarding complexity, self-organization, and so on. The epilogue closes the book on the optimistic note that science 'gives us a means to predict the consequences of our actions and perhaps, with wisdom, to save us from ourselves'.

The universal laws and organizing principles governing matter, energy, forces and motion are presented clearly. Matter in every form, from the atom and its sub-atomic constituents to the galactic dust is discussed along with the new-fangled forms of engineered materials. The four fundamental forces and fields are linked to the mechanism of the universe. The various conservation laws are stated clearly. Two chapters describe the restless earth and the various oceanic and atmospheric cycles. Four chapters unravel the miracle of life; the operating principles of natural selection and the transmission through genetic codes and the ladder-like connection from the fundamental molecular units to the ecosystem of the biosphere are nicely brought out.

No book, written on the 'What you need to know and where to find it' formula can be complete without a discussion on any of the following issues: acid rain, genetic engineering, green house effect, mass extinctions, ozone depletion and the ozone hole. The scientific components behind these issues are treated in a balanced and responsible way. The Law of Unintended Consenquences is neatly brought out here: that in complex systems (eco as well as socio-economic), it is not possible to predict what the consequences of any change will be – small changes can have devastating effects while huge changes can leave the system largely unruffled.

As an aerospace structural engineer who has found that extremal-action principles play a defining role in the development of his discipline, I noticed its omission immediately. No effort was made to demonstrate that the underlying laws of the physical world are governed by a preference for economy which can be summed up by extremization or optimum principles. Perhaps, it was felt that one need not know these principles at this elementary expository level.

A very useful bibliography recommending additional reading material is organized chapter-wise and appears at the back of the book.

A compelling case is made out that science really *does* matter because of the way it has altered our daily lives. A cynic may add, lifting us from pain, drudgery and boredom but giving us a lot of things we don't need to buy and offering persuasive dream merchants the reach through the miracle media (print and electronic) to make us spend money we have not got – virtual dreams and virtual reality. Such is the trap that Socrates, Buddha and Gandhi warned us about.

Hazen and Trefil's book is informative, written in a very accessible way and draws many commonplace analogies and metaphors. Both have had excellent track records as scientists doing original research as well as being outstanding communicators of popular science. The Universities Press Edition of this book, which was issued originally in 1991, at a very affordable prize is a must for every home and every school and college library.

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